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Veröffentlicht

Mit internationalem Recherchenbericht.

Vor Ablauf der für Änderungen der Ansprüche zugelassenen
Frist; Veröffentlichung wird wiederholt falls Änderungen
eintreffen.

(54) Title: DEVICE FOR MONITORING THE FLAMES OF OIL BURNERS, WITH ADAPTIVE PROPERTIES

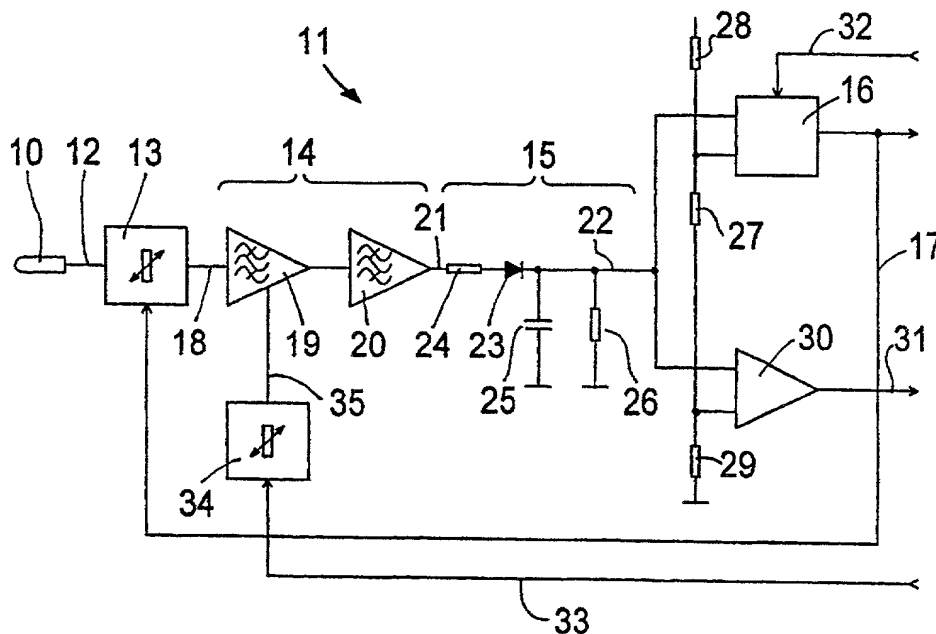
(54) Bezeichnung: VORRICHTUNG ZUR FLAMMENÜBERWACHUNG BEI ÖLBRENNERN MIT ADAPTIVEN EIGENSCHAFTEN

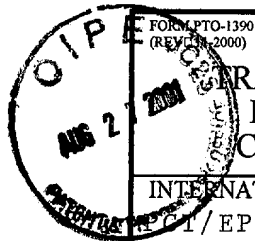
(57) Abstract

The invention relates to a device for monitoring the flames of oil burners. Said device comprises a sensor (10) and an amplifier circuit (11). According to the invention, the sensitivity of the amplifier circuit (11) automatically adapts itself to the actual level of the signal (12) detected by the sensor (10), thereby making sure that the inventive device exhibits an optimum sensitivity across the entire range of dynamics of a flame to be monitored.

(57) Zusammenfassung

Die Erfindung betrifft eine Vorrichtung zur Flammenüberwachung bei Ölbrennern. Die erfindungsgemäße Vorrichtung zur Flammenüberwachung bei Ölbrennern verfügt über einen Sensor (10) und eine Verstärkerschaltung (11). Erfindungsgemäß paßt sich die Empfindlichkeit der Verstärkerschaltung (11) automatisch an den tatsächlichen Pegel des vom Sensor (10) erfaßten Signals (12) automatisch an. Hierdurch ist gewährleistet, daß die erfindungsgemäße Vorrichtung über den gesamten Dynamikbereich einer zu überwachenden Flamme eine optimale Empfindlichkeit aufweist.



FORM PTO-1390
(REV. 1-2000)

US DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

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09/914459

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PCT/EP00/01464

INTERNATIONAL FILING DATE

23 February 2000

PRIORITY DATE CLAIMED

02 March 1999

TITLE OF INVENTION Device for Monitoring the Flames of Oil Burners With Adaptive Properties

APPLICANT(S) FOR DO/EO/US

Willi Nyffenegger; Daniel Albrecht

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

- 1 ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. § 371 ☐
- 2 ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. § 371 ☐
- 3 ☒ This is an express request to begin national examination procedures (35 U.S.C. § 371(f)) ☐ The submission must include items (5), (6), (9) and (21) indicated below ☐
- 4 ☒ The US has been elected by the expiration of 19 months from the priority date (Article 31) ☐
- 5 ☒ A copy of the International Application as filed (35 U.S.C. § 371(c)(2))
 - a ☐ is attached hereto (required only if not communicated by the International Bureau) ☐
 - b ☒ has been communicated by the International Bureau ☐
 - c ☐ is not required, as the application was filed in the United States Receiving Office (RO/US) ☐
- 6 ☒ An English language translation of the International Application as filed (35 U.S.C. § 371(c)(2)) ☐
 - a ☒ is attached hereto ☐
 - b ☐ has been previously submitted under 35 U.S.C. § 54(d)(4) ☐
- 7 ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. § 371(c)(3))
 - a ☐ are attached hereto (required only if not communicated by the International Bureau) ☐
 - b ☐ have been communicated by the International Bureau ☐
 - c ☐ have not been made; however, the time limit for making such amendments has NOT expired ☐
 - d ☐ have not been made and will not be made ☐
- 8 ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. § 371(c)(3)) ☐
- 9 ☒ An oath or declaration of the inventor(s) (35 U.S.C. § 371(c)(4)) ☐
- 10 ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. § 371(c)(5)) ☐

Items 11 to 20 below concern document(s) or information included:

- 11 ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98 ☐
- 12 ☒ An assignment document for recording ☐ A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included ☐
- 13 ☐ A **FIRST** preliminary amendment ☐
- 14 ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment ☐
- 15 ☐ A substitute specification ☐
- 16 ☐ A change of power of attorney and/or address letter ☐
- 17 ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter(2) and 35 U.S.C. § 821 - 1.825 ☐
- 18 ☐ A second copy of the published international application under 35 U.S.C. § 54(d)(4) ☐
- 19 ☐ A second copy of the English language translation of the international application under 35 U.S.C. § 54(d)(4) ☐
- 20 ☐ Other items or information:

USCAP APPLICATION NO. (Show 37 CFR 1.53) 09/914459		INTERNATIONAL APPLICATION NO. PCT/EP00/01464		ATTORNEY'S DOCKET NUMBER 792-25494US	
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21 <input checked="" type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO <input type="text"/> \$1000.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO <input type="text"/> \$860.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO <input type="text"/> \$710.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) <input type="text"/> \$690.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) <input type="text"/> \$100.00 ENTER APPROPRIATE BASIC FEE AMOUNT =				CALCULATIONS PTO USE ONLY <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: right;">\$ 860.00</td> <td style="width: 50%;"></td> </tr> <tr> <td style="text-align: right;">\$</td> <td></td> </tr> </table>		\$ 860.00		\$	
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Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)) <input type="checkbox"/>				<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: right;">\$</td> <td style="width: 50%;"></td> </tr> <tr> <td style="text-align: right;">\$</td> <td></td> </tr> </table>		\$		\$	
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CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE						
Total claims	6 - 20 =	0	x \$18.00						
Independent claims	1 - 3 =	0	x \$80.00						
MULTIPLE DEPENDENT CLAIM(S) (if applicable) 10				+ \$270.00					
TOTAL OF ABOVE CALCULATIONS =				\$3560.00					
<input type="checkbox"/> Applicant claims small entity status <input type="checkbox"/> See 37 CFR 1.27 <input type="checkbox"/> The fees indicated above are reduced by 1/2 <input type="checkbox"/>				\$ +					
SUBTOTAL =				\$3560.00					
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)) <input type="checkbox"/>				\$					
TOTAL NATIONAL FEE =				\$3560.00					
Fee for recording the enclosed assignment (37 CFR 1.21(h)) <input type="checkbox"/> The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) <input type="checkbox"/> \$40.00 per property +				\$					
TOTAL FEES ENCLOSED =				\$3560.00					
				Amount to be refunded:	\$				
				charged:	\$				

a ☐ A check in the amount of \$ _____ to cover the above fees is enclosed ☐

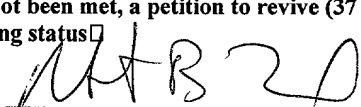
b ☒ Please charge my Deposit Account No. 01-1125 in the amount of \$ 3560.00 to cover the above fees ☐
 A duplicate copy of this sheet is enclosed ☐

c ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any
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d ☐ Fees are to be charged to a credit card ☐ **WARNING:** Information on this form may become public ☐ Credit card
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NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR
 1.137 (a) or (b)) must be filed and granted to restore the application to pending status ☐

SEND ALL CORRESPONDENCE TO:


 SIGNATURE
 Robert B. Leonard
 NAME
 33,946
 REGISTRATION NUMBER

??-??-2000

PCT/EP00/01464

DESCPAMD

SATRONIC AG

December 1, 2000

PCT/EP00/01464

79225494 WO

Device for monitoring the flames of oil burners with
adaptive properties

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The invention relates to a device for monitoring the flames of oil burners according to the preamble of claim 1.

10 Such devices for monitoring flames have as a rule a sensor which detects the light of the flame of the burner and generates a corresponding signal therefrom, and an amplifier circuit for evaluating the signal detected by the sensor.

15

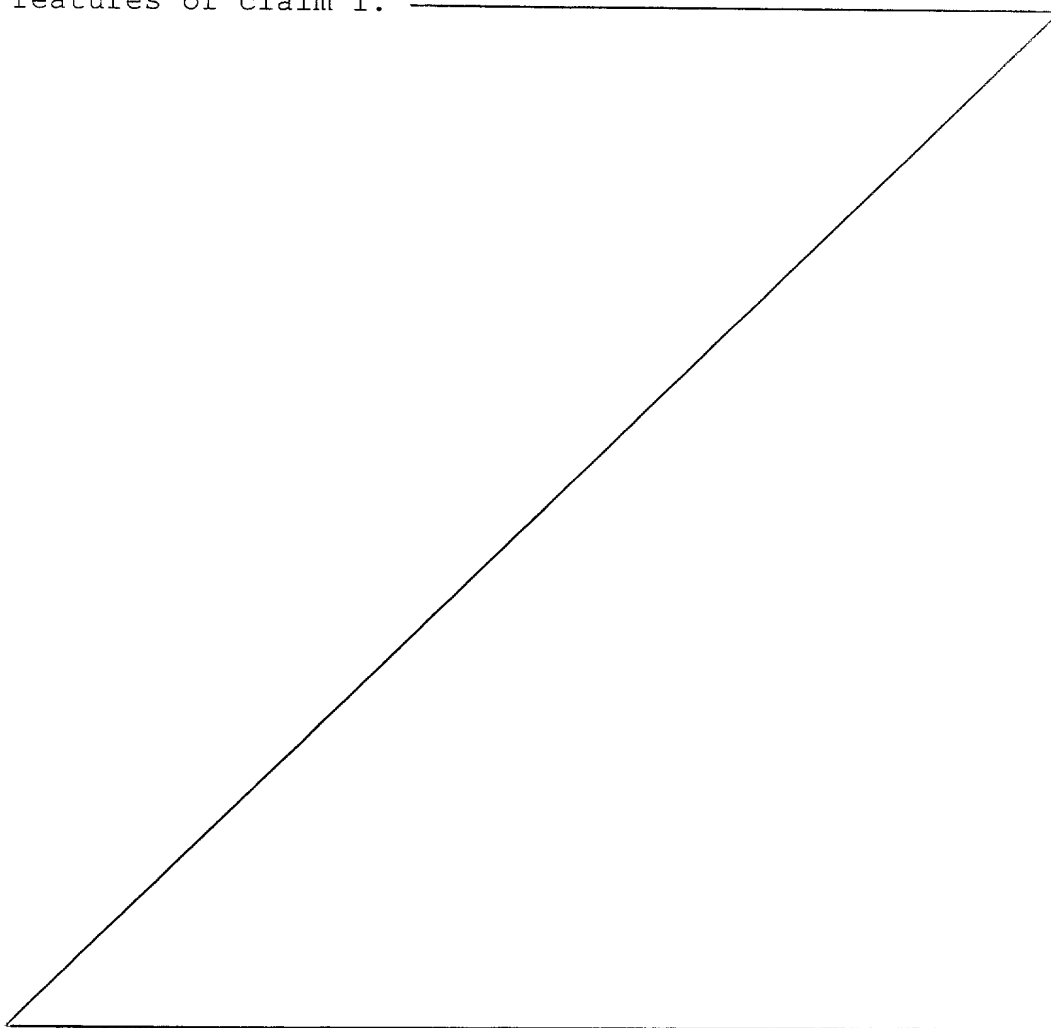
The light of the flame which is to be detected by the sensor has a large range of dynamics depending on the operating state of the oil burner. In a "cold" oil burner, that is to say when the oil burner starts up,
20 only a small signal is detected by the sensor, while in the case of a "hot" oil burner there is a large signal. These dynamics entail the problem that the requirements of sensitivity of such devices vary over time because it is necessary to ensure both reliable starting up and
25 switching off of the oil burner.

In devices for monitoring flames according to the prior art, allowance is not made for the upper range of dynamics, that is to say the sensitivity of the devices
30 for monitoring flames is merely set to a fixed value. A direct consequence is that the method of operation of the devices according to the prior art can only be less than optimum.

As prior art, reference is made to DE-A 196 50 972 which discloses a method and an arrangement for monitoring and controlling combustion processes. In
 5 addition, the prior art comprises EP-A-0 474 430, US-A-4 039 844, US-A-3 903 418, GB-A-1 425 456 and patent abstracts of Japan Vol. 018, No. 023 (M-1541).

10 Taking the above as a starting point, the present invention is based on the problem of providing an optimized device for monitoring flames in oil burners.

This problem is solved by means of a device having the features of claim 1.



Taking the above as a starting point, the present invention is based on the problem of providing an optimized device for monitoring flames in oil burners.

- 5 This problem is solved by means of a device having the features of claim 1.

Further advantageous refinements of the invention emerge from the subclaims and the description. A
10 preferred exemplary embodiment of the invention is explained in more detail below with reference to the drawing, in which:

15 fig. 1 shows a device according to the invention for monitoring flames in oil burners as a schematic block diagram.

The device according to the invention shown in the drawing for monitoring flames in oil burners has a
20 sensor 10 and an amplifier circuit 11 assigned to the sensor 10. The sensor 10 monitors a flame (not illustrated) of an oil burner (likewise not illustrated). Specifically, the sensor 10 is preferably an infrared sensor which detects the light of the flame
25 of the oil burner in the infrared range and generates a corresponding signal 12 therefrom. The amplifier circuit 11 is used for evaluating the signal 12 detected by the sensor 10. For the sake of completeness, it is to be noted that the sensor 10 does
30 not have to be embodied as an infrared sensor. Instead, it is also possible to use other sensors for monitoring the flame of the oil burner.

35 The amplifier circuit 11 according to the invention automatically adapts its sensitivity to the actual level of the signal 12 detected by the sensor 10. This ensures that the amplifier circuit 11, and thus the

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device composed of the sensor 10 and the amplifier circuit 11 and having the purpose of monitoring flames is independent of the state of the burner, that is to say operates reliably over the entire range of dynamics
5 of the flame of the oil burner.

For this purpose, the amplifier circuit 11 has a voltage divider device 13, a filter device 14, a rectifier device 15 and an amplifier device 16.
10 According to figure 1, the signal 12 detected by the sensor 10 and a control signal 17 are used as input variables for the voltage divider device 13. In the voltage divider device 13, which may be embodied as a combination of a fixed resistor and variable resistor,
15 the signal 12 detected by the sensor 10 and the control signal 17 are mathematically combined with one another in such a way that the amplitude of the signal 12 detected by the sensor is set to a defined amplitude. This signal which is set to the defined amplitude is
20 the output signal 18 of the voltage divider device 13 which is fed to the filter device 14 as input signal. The filter device 14 comprises two filters, namely a first bandpass filter 19 and a second bandpass filter
25 19. In the filter device 14, the output signal 18 of the voltage divider 13 is accordingly filtered, and an output signal 21 of the filter device 14 is subsequently fed to the rectifier device 15 which generates a rectified output signal 22 from the output
30 signal 21 present in the form of an alternating voltage. The output signal 22 is consequently a filtered and rectified output signal of the sensor 10 which is set to the defined amplitude. As is apparent from figure 1, the rectifier device 15 has a resistor
35 24 which is connected in series with a diode 23, the series circuit composed of the diode 23 and the

resistor 24 being respectively connected in parallel with a capacitor 25 and a further resistor 26.

According to figure 1, the output signal 22 of the
5 rectifier device 15 is fed as input signal to the
amplifier device 16. Furthermore, a reference signal
which is made available by means of appropriately
dimensioned resistors 27, 28 and 29 is fed as setpoint
10 value to the amplifier device 16. The reference signal
for the amplifier device 16 is tapped between the
resistors 27 and 28 in accordance with figure 1. The
amplifier device 16 generates the control signal 17
from these input signals. An embodiment of the
15 amplifier device 16 is particularly advantageous if it
has a proportional/integral amplification
characteristic.

The output signal 22 of the rectifier device 15 is
20 additionally fed to a comparator 30 as input signal
which compares the output signal 22 of the rectifier
device 15 with a reference value which is tapped
between the resistors 29 and 27. This reference value
for the comparator 30 is, for example, 70% of the
25 defined amplitude to which the signal 12 determined by
the sensor 10 is set in the voltage divider device 13.
The comparator 30 makes available, as output variable
31, a flame signal which contains information on the
presence or nonpresence of the flame of the oil burner.

30 Because, as stated above, the amplitude of the signal
12 detected by the sensor 10 is always normalized
automatically to the defined amplitude, the sensitivity
of the amplifier circuit 11 is optimized over the
entire range of dynamics of the flame of the oil
35 burner.

As has already been stated above, the amplifier device 16 has a proportional/integral amplification characteristic. The amplification characteristic of the amplified device 16 is configured here in such a way that an increasing output signal 22 is compensated quickly while a decreasing output signal 22 is compensated slowly. This ensures that in the event of a failure of the flame the output signal 22 drops rapidly below the threshold value of, preferably, 70% and the comparator can thus signal a corresponding failure of the flame reliably and quickly.

The amplification characteristic of the amplifier device 16 can, according to figure 1, also be varied by means of a signal 32. This property is significant if the device according to the invention is to be used in oil burners with multi-setting operation. For example, specifically in conjunction with multi-setting oil burners, when there is a switch-over from one power setting to another setting of the oil burner, a sudden change in the light conditions with respect to the flame of the oil burner may take place. In such a case it is necessary to reliably prevent a reduction, caused by this, in the signal 12 detected by the sensor 10 being interpreted as an extinction or failure of the flame. For this purpose, the amplification characteristic of the amplifier device 16 is set to a maximum in synchronism with a switch-over of the setting of the oil burner. As a result, specifically when there is a switch-over of the setting of the oil burner, the amplifier circuit 11 is accordingly sensitized instantaneously in such a way that when the signal 12 decreases suddenly owing to a switch-over of the setting it is possible to reliably conclude that a flame of the oil burner is present.

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Furthermore, the amplifier circuit 11 has a self-test function. For this purpose, the amplifier circuit 11 can be supplied with a self-test signal 33 by means of a second voltage divider device 34. The self-test signal 33 serves here as an input variable for the second voltage divider device 34, an output variable 35 of the second voltage divider device 34 being made available to the filter device 14, namely the first bandpass filter 19, as an input variable. The self-test signal 33 is a sequence of pulses, the amplification of the first bandpass filter 19 being reduced to preferably a third of its nominal amplification by means of the voltage divider device 34 in synchronism with the pulses of the self-test signal 33. An evaluation circuit (not illustrated) which is connected downstream of the comparator 30 checks whether the comparator 30 detects the signal reduction carried out with the clock of the pulses of the self-test signal 33. If this is the case, the amplifier circuit 11 is operating without faults. It is significant here that the amplification of the first bandpass filter 19 is not reduced to zero by means of the voltage divider device 34 but rather is preferably only divided by three or even halved. If the amplifier device 16 overdrives owing to a fault, the division by three or halving of the amplification of the first bandpass filter 19 is in fact not sufficient for the comparator 30 to be able to react appropriately to the pulses of the self-test signal 33. A fault is thus detected. However, if the amplification of the first bandpass filter 19 has been reduced to zero, the comparator 30 would react to the pulses in the self-test signal even in the case of an overdriving amplifier device 16, and would then not be able to detect the fault.

35

It is advantageous also if the device according to the invention composed of the sensor 10 and the adaptive

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amplifier circuit 11 is integrated into a digital, microprocessor-controlled controller. With this integration it is in fact possible to use the device according to the invention in an optimum way. For example, a digital microprocessor-controlled controller can directly evaluate the output variable 31 of the comparator 30. A digital controller can also reliably and easily generate the self-test signal 33 and the signal 32. Furthermore, the control signal 17 can also be easily evaluated. Furthermore, integration of the device according to the invention into a microprocessor also results in a cost saving because the structural design is simplified.

List of reference numerals

- 10 Sensor
- 11 Amplifier circuit
- 12 Signal
- 13 Voltage divider device
- 14 Filter device
- 15 Rectifier device
- 16 Amplifier device
- 17 Control signal
- 18 Output signal
- 19 Bandpass filter
- 20 Bandpass filter
- 21 Output signal
- 22 Output signal
- 23 Diode
- 24 Resistor
- 25 Capacitor
- 26 Resistor
- 27 Resistor
- 28 Resistor
- 29 Resistor
- 30 Comparator
- 31 Output variable
- 32 Signal
- 33 Self-test signal
- 34 Voltage divider device
- 35 Output variable

Patent claims

1. A device for monitoring the flames of oil burners, having a sensor (10) and an amplifier circuit (11) for evaluating the signal (12) detected by the sensor (10), the sensitivity of the amplifier circuit (11) adapting itself automatically to the actual level of the signal (12) detected by the sensor (10), characterized in that a control signal (17) generated by the amplifier circuit (11) is mathematically combined with the signal (12) detected by the sensor (10) in a voltage divider device (13) of the amplifier circuit (11).
2. The device as claimed in claim 1, characterized in that the control signal (17) sets the amplitude of the signal (12) detected by the sensor (10) to the defined amplitude.
3. The device as claimed in claim 1 or 2, characterized in that an output variable (18) of the voltage divider device (13) then successively passes through a filter device (14), a rectifier device (15) and an amplifier device (16), and in that the output signal of the amplifier device (16) is the control signal (17).
4. The device as claimed in one or more of claims 1 to 3, characterized in that the voltage divider device (13) is embodied as an adjustable resistor, and in that the filter device (14) preferably has two bandpass filters (19, 20) connected in series.
5. The device as claimed in one or more of claims 1 to 4, characterized in that the rectifier device (15) comprises a resistor (24) connected in series

with a diode (23), a capacitor (25) which is connected in parallel with each of these elements, and a resistor (26).

- 5 6. The device as claimed in one or more of claims 1 to 5, characterized in that the amplifier circuit (11) also has a comparator (30), the comparator (30) comparing the output signal (22) of the rectifier device (15) with a reference value and
10 generating therefrom a flame signal (31) which contains information on the presence of a flame of the oil burner.
- 15 7. The device as claimed in one or more of claims 1 to 6, characterized in that a self-test signal (33) which is used for functional checking of the amplifier circuit (11) can be fed to the amplifier circuit (11).
- 20 8. The device as claimed in claim 7, characterized in that the self-test signal (33) can be fed to a second voltage divider device (34) which forms an input signal for the filter device (14) therefrom.
- 25 9. The device as claimed in claim 7 or 8, characterized in that the second voltage divider device (34) reduces the amplification of a first bandpass filter (19) as a function of a clock of the pulses of the self-test signal (33), the
30 functional checking being permanently superimposed on the actual monitoring of the flames.
- 35 10. The device as claimed in claim 9, characterized in that the amplification of the first bandpass filter (19) is divided into three or halved, that is to say is not reduced to zero.

11. The device as claimed in one or more of claims 1 to 10, characterized in that the amplifier device (16) of the amplifier circuit (11) has a proportional/integral amplification characteristic.
12. The device as claimed in claim 11, characterized in that the amplification characteristic of the amplifier device (16) is changed to a predefined, sensitive state by a signal (32).
13. The device as claimed in claim 11 or 12, characterized in that the signal (32) for changing the integral amplification factor is activated as a function of setting switching-over operations of the oil burner in multi-setting burner operating mode in order to reliably detect the presence of a flame of the oil burner even during a setting switching-over operation.
14. The device as claimed in one or more of claims 1 to 13, characterized in that the amplifier circuit (11) is integrated into a microprocessor, in particular into a microprocessor-controlled controller.

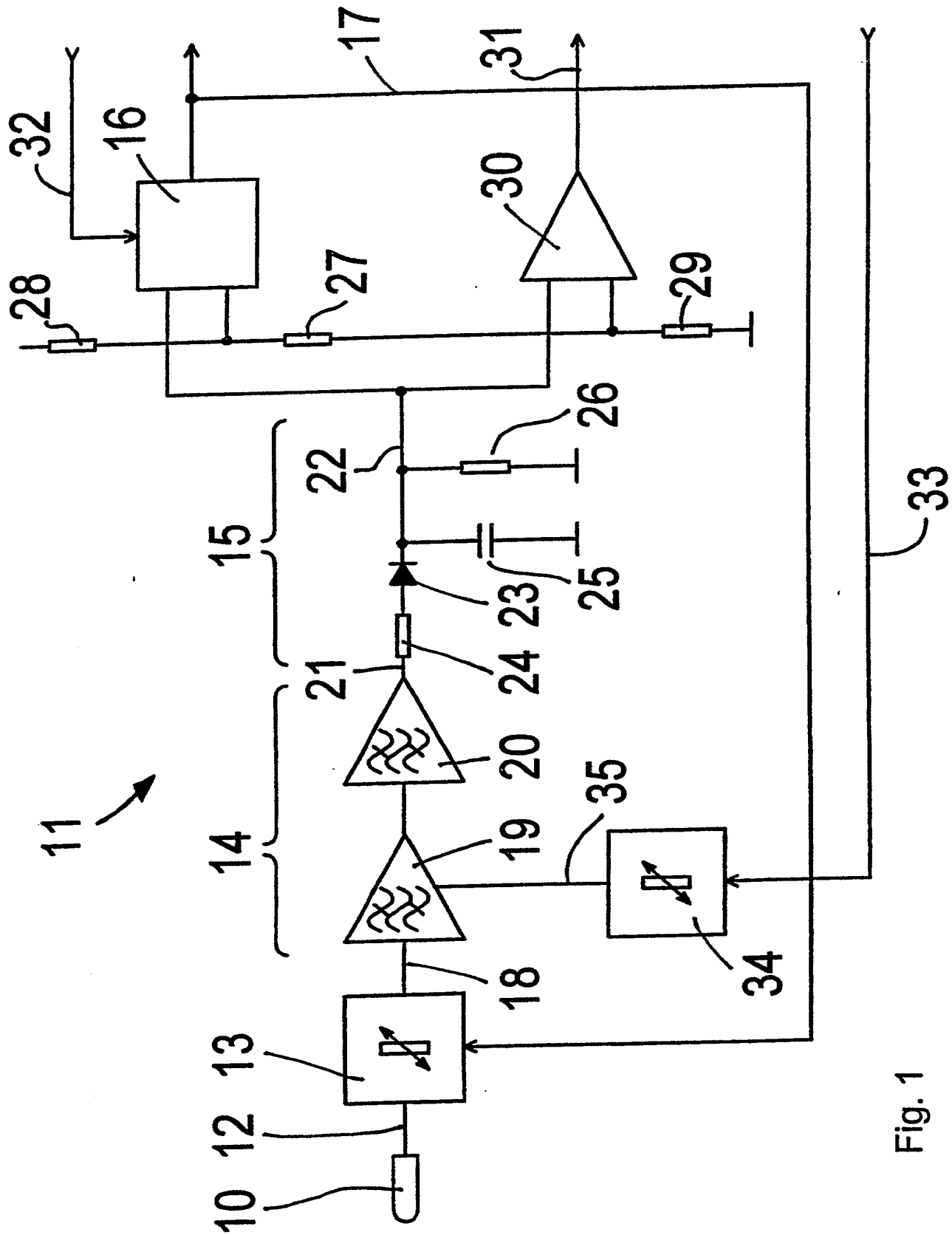
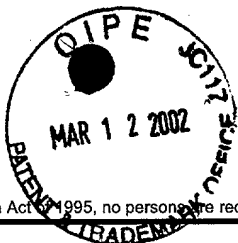


Fig. 1



#40

PTO/SB/01 (10-01)
Approved for use through 10/31/2002. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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**DECLARATION FOR UTILITY OR
DESIGN
PATENT APPLICATION
(37 CFR 1.63)**

☐ Declaration Submitted with Initial Filing
OR
☒ Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)

Attorney Docket Number 792-25494 US

First Named Inventor W. Nyffenegger

COMPLETE IF KNOWN

Application Number 09/914,459

Filing Date

Art Unit

Examiner Name

As the below named inventor, I hereby declare that:

My residence, mailing address, and citizenship are as stated below next to my name.

I believe I am the original and first inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

DEVICE FOR MONITORING THE FLAMES OF OIL BURNERS WITH
ADAPTIVE PROPERTIES

(Title of the Invention)

the specification of which

☐ is attached hereto

OR

☒ was filed on (MM/DD/YYYY) 02/23/2000

as United States Application Number or PCT International

Application Number PCT/EP00/01464 and was amended on (MM/DD/YYYY) (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

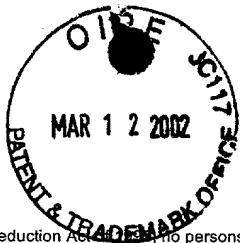
I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
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☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

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NAME OF SOLE OR FIRST INVENTOR :

☐ A petition has been filed for this unsigned inventor

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☐ Additional inventors are being named on the _____ supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto.